WEAR LEVEL INDICATING FILAMENTS AND FABRICS(AND GUIDELINE APPLICATIONS)

Field of the Invention

5   The present invention is directed towards means for detecting the wear level of, and creating guidelines on, papermaking and other industrial fabrics, particularly towards multilayered and 10   conductive filaments used as such a means.

Background of the Invention

During the papermaking process, a cellulosic fibrous web is formed by depositing a fibrous slurry, 15   that is, an aqueous dispersion of cellulose fibers, onto a moving forming fabric in the forming section of a paper machine. A large amount of water is drained from the slurry through the forming fabric, leaving the cellulosic fibrous web on the surface of 20   the forming fabric.

The newly formed cellulosic fibrous web proceeds from the forming section to a press section, which includes a series of press nips. The cellulosic fibrous web passes through the press nips supported 25   by a press fabric, or, as is often the case, between two such press fabrics. In the press nips, the cellulosic fibrous web is subjected to compressive forces which squeeze water therefrom, and which adhere the cellulosic fibers in the web to one 30   another to turn the cellulosic fibrous web into a paper sheet. The water is accepted by the press fabric or fabrics and, ideally, does not return to the paper sheet.

1   00129445

The paper sheet finally proceeds to a dryer section, which includes at least one series of rotatable dryer drums or cylinders, which are internally heated by steam. The newly formed paper sheet is directed in a serpentine path sequentially around each in the series of drums by a dryer fabric, which holds the paper sheet closely against the surfaces of the drums. The heated drums reduce the water content of the paper sheet to a desirable level through evaporation.

It should be appreciated that the forming, press and dryer fabrics all take the form of endless loops on the paper machine and function in the manner of conveyors. It should further be appreciated that paper manufacture is a continuous process which proceeds at considerable speeds. That is to say, the fibrous slurry is continuously deposited onto the forming fabric in the forming section, while a newly manufactured paper sheet is continuously wound onto rolls after it exits from the dryer section.

Operating, as they do, in the form of endless loops on paper machines, papermaker's fabrics, and particularly their inner surfaces, are susceptible to abrasive wear. Much of this wear results from contact with stationery components of the paper machine. Ultimately, many fabrics must be removed from paper machines when the wear caused by such moving contact has reduced the thickness of the fabric, at least in some locations, to the point where it is weakened or has lost some quality or characteristic desired by papermakers in its particular application.

00129445

Normally, wear is monitored using a thickness gauge. However, it is difficult to measure the thickness of a papermaker's fabric more than a foot or two in from its edges with such a gauge, especially when the fabric is running on a paper machine.

Clearly, a means for monitoring wear on a papermaker's fabric, and particularly at any point on its inner and outer surfaces, even when the paper machine is operating, would be very helpful to those in the papermaking industry. The present invention provides such a means to the industry.

Summary of the Invention

It is therefore a principal object of the invention to provide for an industrial fabric having a built-in mechanism that enables wear of the fabric to be monitored.

It is a further object of the invention to provide for a fabric which has a detectable guideline.

This and other objects and advantages are provided by the present invention. In this regard, the present invention is directed towards a fabric which includes multilayer filaments comprising a core yarn surrounded by one or more outside layers. The core and the layers are visibly distinguishable from one another by, for example, their contrasting color, or reflectivity. This enables fabric wear to be monitored as abrasion gradually wears away successive layers of the filaments, eventually revealing the core yarns.

00129445

In a second aspect of the invention, conductive monofilaments are woven into the wear side of a fabric to create another type of wear detection system. By measuring, for example, the resistance in the cross direction of the fabric, it is possible to determine the level of wear.

In a third aspect of the invention, the multilayer filaments are used to create a visible guideline on the fabric in CD and/or MD directions. The guideline is not removable by high-pressure showers or chemical cleaning, and is used for determining belt alignment, speed measurements, or as a trigger for an electronic guiding system.

In a fourth aspect of the invention, a conductive filament having a contrasting color is used to create a permanent guideline on a fabric. The color contrast or the electrical properties of the filaments can be used as a trigger for on-line speed measurements or as a trigger for an electronic guiding system.

Brief Description of the Drawings

Thus by the present invention, its objects and advantages will be realized the description of which should be taken in conjunction with the drawings wherein:

Figure 1 is a cross sectional view of the an example of a multilayered filament according to the present invention;

Figure 2 is side and top views of the multilayered filament in Figure 1 exhibiting wear, incorporating the teachings of the present invention;

4   00129445

Figure 3 is a cross sectional view of the an example of a multilayered optical filament according to another aspect of the invention;

Figure 4 is a top view of an example of a fabric comprising the multilayered filaments of Figures 1, 2 and 3;

Figure 5 is a top view of the fabric in Figure 4, exhibiting wear;

Figures 6 and 7 illustrate examples of fabrics with, respectively, CD and MD guidelines, incorporating the teachings of the present invention.

Detailed Description of the Preferred Embodiments

A preferred embodiment of the present invention will be described in the context of filaments and fabrics woven therefrom used in papermaking. However, it should be noted that the invention is applicable to the fabrics used in other industrial settings where wear detection and guiding are of importance.

Fabric constructions include woven, spiral wound, knitted, extruded mesh, spiral coil, and other nonwoven fabrics. These fabrics may also include monofilament, plied monofilament, multifilament or plied multifilament yarns, and may be a single-layer weave, a multi-layer weave or laminated. When the fabric is a spiral coil fabric, the filament can be the coils, the yarns used to connect the coils or the inserts (stuffers) that may be present in the coil interior void. The yarns are typically extruded from any one of the synthetic polymeric resins, such as polyamide and polyester resins, used for this purpose

by those of ordinary skill in the industrial fabric arts.

An example of the multilayer filament 10 of the present invention is illustrated in Figure 1 (cross-sectional view). The filament 10 can comprise, for example, a core yarn 12 surrounded by a plurality of outside layers 14, 16, 18. Advantageously, the core 12 and the surrounding layers 14, 16, 18 are visibly distinguishable from one another by, for example, their contrasting color, or reflectivity. This enables the wear of fabrics comprising such filaments 10 to be monitored as abrasion gradually wears away successive layers 14, 16, 18 of the filaments 10, eventually revealing the core yarns 12. An example of the multilayered filament 10 exhibiting such wear is shown in Figure 2 (cross-sectional view and plan view).

In alternative embodiments (not shown) the core 12 and the layers 14, 16, 18 can also be doped with dyes or other substances that will change their appearance. The dye would then be detectable by a sensor when excited with an external energy source, for example, a light (e.g., laser, or UV) or ultra sound.

In yet a further embodiment, the filaments 10 can also comprise a light absorbing/transmitting core 12 and several transparent layers 14, 16, 18 having varying refractions n1, n2, n3. An example of this multilayer optical filament 10 is shown in Figure 3. In this case, the transmitted/reflected light from the filament 10 changes color depending on the wear level through the layers 14, 16, 18.

Figure 4 is a plan view of an unused fabric 20 (wear side) comprising at least some of the multilayered filaments 10, according to the teachings of the present invention. Fabric 20 can be a structure woven from yarns 10 lying in the cross-machine direction (CD) and yarns 22 lying in the machine direction (MD), although it need not be woven to fall within the scope of the present invention, and could be a nonwoven structure. In Figure 4, CD yarns 10 which are multilayered filaments of the variety shown in Figures 1, 2 and 3 are depicted as weaving with MD yarns 22 in a plain weave. In the example shown, the knuckles 24 on the surface of the fabric 20 are most susceptible to wear because they are formed where a yarn in one direction of the fabric 20 passes or crosses over one in the other direction, and are therefore elevated points on the surface of the fabric 20.

After the fabric 20 has been used for some period of time, the same plan view of the fabric 20 will appear as shown in Figure 5. At least one or more of the outer layers 16, 18 of the CD multilayered filaments 10 are shown to be worn away to the point where an inner layer 14 or the core 12 is exposed to view. By virtue of its different color or reflectivity, for example, compared to that of the outer layers 16, 18, the inner layer 14 or core 12 gives an indication of the wear of the fabric 20.

Alternatively, the CD yarns 10 can be conductive monofilaments woven into the wear side of fabric 20 to provide another means of wear detection. Thus, by measuring the conductivity in the CD direction of the fabric 20 over a period of use, a corresponding level

7

of fabric wear is determined. That is, less cross sectional area of the conductive monofilaments corresponds to lower conductivity in the CD direction of the fabric 20.

5   In another aspect of the invention, shown in Figures 6 and 7, the multilayer filaments 10 are used to create a visible guideline 30 on a fabric in the CD and/or MD directions. This guideline 30 is used for determining belt alignment, on-line speed

10   measurements, or as a trigger for an electronic guiding system. Advantageously, the guideline 30 is not removable by high-pressure showers or chemical cleaning. Alternatively, a conductive monofilament having a contrasting color can also be used to create

15   the guideline 30 on the fabric. In this case, the color contrast and/or the electrical properties of the monofilaments can be used as the trigger for on-line speed measurements or as the trigger for the electronic guiding system. In all cases, the

20   filament used can be either round or non-round in cross section. If the yarn is a multifilament, that is, a yarn that has more than one filament, each filament can be the inventive filament, or at least one filament can have the inventive (e.g.,

25   conductive) property. As for all aspects of the invention recited, however, there should be sufficient filaments in a multifilament yarn that have the inventive property so as to achieve the desired results.

30   Thus by the present invention its objects and advantages are realized, and although preferred embodiments have been disclosed and described in detail herein, its scope and objects should not be

8

limited   thereby;   rather   its   scope   should   be
determined by that of the appended claims.